DELHI PHARMACEUTICAL SCIENCES & RESEARCH UNIVERSITY

PRE-SUBMISSION
(4RTH) DSRC Report
for
Doctor of Philosophy (Ph.D.)

Govt. of N.C.T. of Delhi,
Pushp Vihar, Sector – III, M.B. Road,
New Delhi-110017
Website: www.dpsru.edu.in
(Approved by UGC under section 2f of UGC Act)
Accreditation by Life Sciences Sector Skill Development Council

DELHI PHARMACEUTICAL SCIENCES & RESEARCH UNIVERSITY

Research Scholar: Arzoo

Registration No. : 01/PhD/DPSRU/2018

Registration Date: 13th August 2018

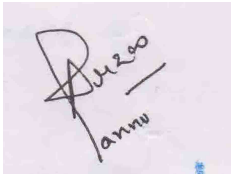
PhD Supervisor: Prof. Ramesh K. Goyal

Project Title: Evaluation of *Scutellaria barbata* D. Don for the development of a novel herbal formulation for depression

PART – A

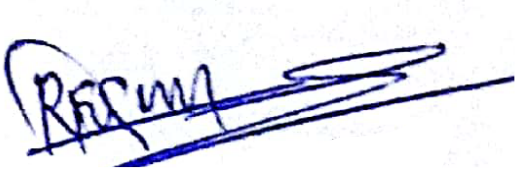
PROFORMA FOR HALF-YEARLY PROGRESS REPORT OF REGISTERED RESEARCH SCHOLARS FOR THE PERIOD: MAY 2022 to April 2024

1. Name of Research Scholar: Arzoo
2. Correspondence Address: RPS colony, Pushp Vihar, Delhi- 110017
3. Contact No.: 9729329375
4. Email: arzoopannu@gmail.com
5. Regn. No.: 01/PhD/DPSRU/2018
6. Date of Regn.: 13/08/2018
7. Semester Fee deposited**: Rs. 30385/- Vide R. No. PH/ADMISSION/DPSRU/11 Dated: 6/11/2017
8. Approved Topic of Research: Evaluation of *Scutellaria barbata* D. Don for the development of a novel herbal formulation for depression
9. Nature of Fellowship, if any: DST-INSPIRE
10. Details of leaves availed during the period under report, if any: Nil
11. *Research work done during the period: Compilation of the thesis.
12. *Research papers published: Annexure II
13. * Any other information not covered above: Nil



Arzoo

Date: 23-05-2024 (Name/Signature of the Research Scholar)



Countersignature of Supervisor

PART - B

REPORT OF THE DSRC

Name of the Research Scholar: Arzoo

Registration no.: 01/PhD/DPSRU/2018

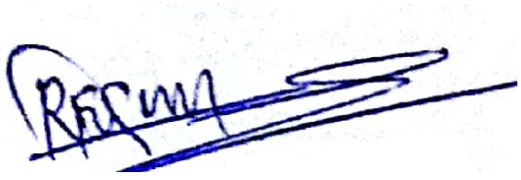
Conduct of the Research Scholar: 4rth DSRC

Progress Report: (Annexure I)

Overall Assessment of the progress and specific comments of the Supervisor:
The candidate carried out extensive work. Results are positive and clear to demonstrate the anti-depressant activity of *S. barbata* D. Don and its phytoconstituents. The candidate also prepared a formulation to be considered for clinical trials. However, the committee felt that as a part of future studies, a phytopharmaceutical product can also be prepared. Overall work is satisfactory and candidate may submit the thesis. The Plagiarism has been checked also, the sililarity index is within the limitation i.e. 5%. Finally the number of paper published are also as per the norms.

Expert

Dr. Arunabha Ray



Supervisor
Prof. Ramesh K. Goyal

Date :23/05/2024

Executive Summary
DSRC: 4rth

Name of Research Scholar:	Ms.Arzoo
Registration number of Research Scholar:	01/Ph.D/2018/DPSRU
Name of Supervisor:	Prof. Ramesh K. Goyal
Date of DSRC:	23-May-2024

Title of thesis:

Evaluation of *Scutellaria barbata* D. Don for the development of a novel herbal formulation for depression

Abstract of work done:

Introduction

Depression is a complex mental health disorder that involves disturbances not only in neurotransmitters like noradrenaline, dopamine, and serotonin but also oxidative stress causing neurodegeneration and neuroinflammation. Although several drugs are available but most of them target a single etiology and produce side effects. *S. barbata* D. Don is reported to produce a diverse spectrum of pharmacological activities ranging from anti-inflammatory to antioxidant effects and neurotransmitters. **It is interesting to note that specific** phytoconstituents present in this plant like Wogonin, Hispidulin, Scutellarein, and Scutellarin have been reported to modulate serotonin, norepinephrine, and dopamine levels respectively and these are the neurotransmitters associated with mood regulation. Thus, it is possible that it has the potential to be suitable for the treatment of depression. The aim of the present study was to evaluate *S. barbata* D. Don using animal models and the development of an herbal formulation for depression.

Methodology

An initial study was carried out for the standardization of *S. barbata* D. Don, as per the WHO guidelines like pharmacognostic and phytochemical investigation. Based on the published reports qualitative and quantitative analysis of phytoconstituents was carried out using validated techniques like biochemical analysis TLC and HPTLC. Some of the phytochemicals like Hispidulin and Scutellarin were isolated and characterized using a UV spectrophotometer, NMR, and LC MS. The quantitative study was done using HPTLC. Safety assessments were done for the hydroethanol extract of *S. barbata* D. Don (HSBE) with acute toxicity studies in mice.

Pharmacological evaluations for antidepressant action were done using the Chronic unpredictable mild stress (CUMS)Induced stress mice model. The stress was given for 21 days and on day 21, a forced swimming test (FST), tail suspension test (TST), open field test (OFT) and sucrose preference test (SPT) were employed to assess the stress in animals. The mother extract of *S. barbata* D (HSBE), and its fractions (n-hexane, dichloromethane, ethyl acetate and n-butanol; 200mg/kg and 400 mg/kg) and phytoconstituents (Wogonin, Hispidulin, Scutellarein, and Scutellarin) were given in the doses of 20 mg/kg and 40 mg/kg. Imipramine (15m/kg) and fluoxetine (20mg/kg) were used as positive controls. Various enzymes like MAO-A and MAO-B, SOD, CAT,

GSH-Px, SR, GSH, and the MDA were estimated in these animals. At the end, we also carried out corticosteroid levels. At the end, we also carried out an estimation of serotonin, norepinephrine, and dopamine levels in the hippocampus, cortex, and hypothalamus of the mice brain. Based on the results of our study, we developed a **phytopharmaceutical formulation using**, 200 mg/kg of HSBE to be the effective dose in mice

Results

The evaluation of *S.barbata* D. Don confirmed to quality standards, acceptable levels of foreign matter, and low moisture content. The total ash value extractive values were in the acceptable range. Phytochemical analysis of the hydroethanol extract reveals the presence of glycosides, alkaloids, carbohydrates, flavonoids, saponins, phenols, tannins, amino acids, and proteins. Quantitative analysis showed the presence of scutellarein, hispidulin, and wogonin, Detailed analyses of these compounds confirmed their structures and purity. No mortality or significant adverse effects were observed in mice treated with the hydroethanol extract of *S. barbata* D. Don at a single dose of 2000 mg/kg, indicating its safety with an LD50 greater than 2000 mg/kg. Detailed assessments of vital organs, biochemical markers, and histopathological examinations further supported that the *S.barbata* D. Don was safe. *S.barbata* D. Don, its fractions, and the phytoconstituents evaluated produced reduced immobility time, increased locomotor activity, and improved sucrose preference in a dose-dependent manner. Neurochemical analysis revealed alterations of serotonin, norepinephrine, and dopamine levels in brain regions. in HSBE-treated animals. There was inhibition of monoamine oxidases, enhancement of antioxidant enzyme activity, and decrease in corticosterone levels supporting the multifaceted actions of HSBE. The tablet formulation (200 mg) could be successfully developed and when evaluated for weight variation, tablet hardness, friability, and disintegration time, it was within the limits.

Conclusion

In conclusion, the findings collectively suggest that the hydroethanol extract of *S. barbata* D. Don exhibits promising antidepressant action. The mechanism of antidepressant activity could be because of some phytoconstituents that specifically affect the neurotransmitter or enzyme involved in depression. A tablet formulation has also been developed and it is hoped that it can be taken further for clinical studies as per the phytopharmaceutical regulation of India.